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# Waste Treatment and Immobilization Plant Operability

## Hanford Advisory Board Tank Waste Committee

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U.S. DEPARTMENT OF  
**ENERGY**



Bechtel National, Inc.

**URS**



**Operability is the ability of the Waste Treatment and Immobilization Plant (WTP) to safely complete its production mission, which is the treatment of Hanford tank waste**



# **The Purpose is to Deliver a Plant that is Fully Operational and Staffed by Fully Trained Personnel**

- Operability was considered in work scope from the beginning of the project
- Assessment of operability is an iterative process that continues throughout the life of the project
- Operability is enhanced by plant operating experience, including best practices and lessons learned
- Assessment of operability improves safety, nuclear operations and is protective of workers, the public and environment



# **Operations and Commissioning Staff are Highly Experienced**

- Successful commissioning and operation of other U.S. Department of Energy (DOE) vitrification facilities
  - West Valley, New York
    - Processed over 600,000 gallons of legacy commercial high-level waste (HLW)
    - Completed production of 278 glass canisters in 2002
  - Defense Waste Processing Facility (DWPF), Savannah River Site (SRS)
    - Processing 32 million gallons of DOE defense-related nuclear waste
    - Produced over 3,780 glass canisters since 1996



# **Operations and Commissioning Staff are Highly Experienced**

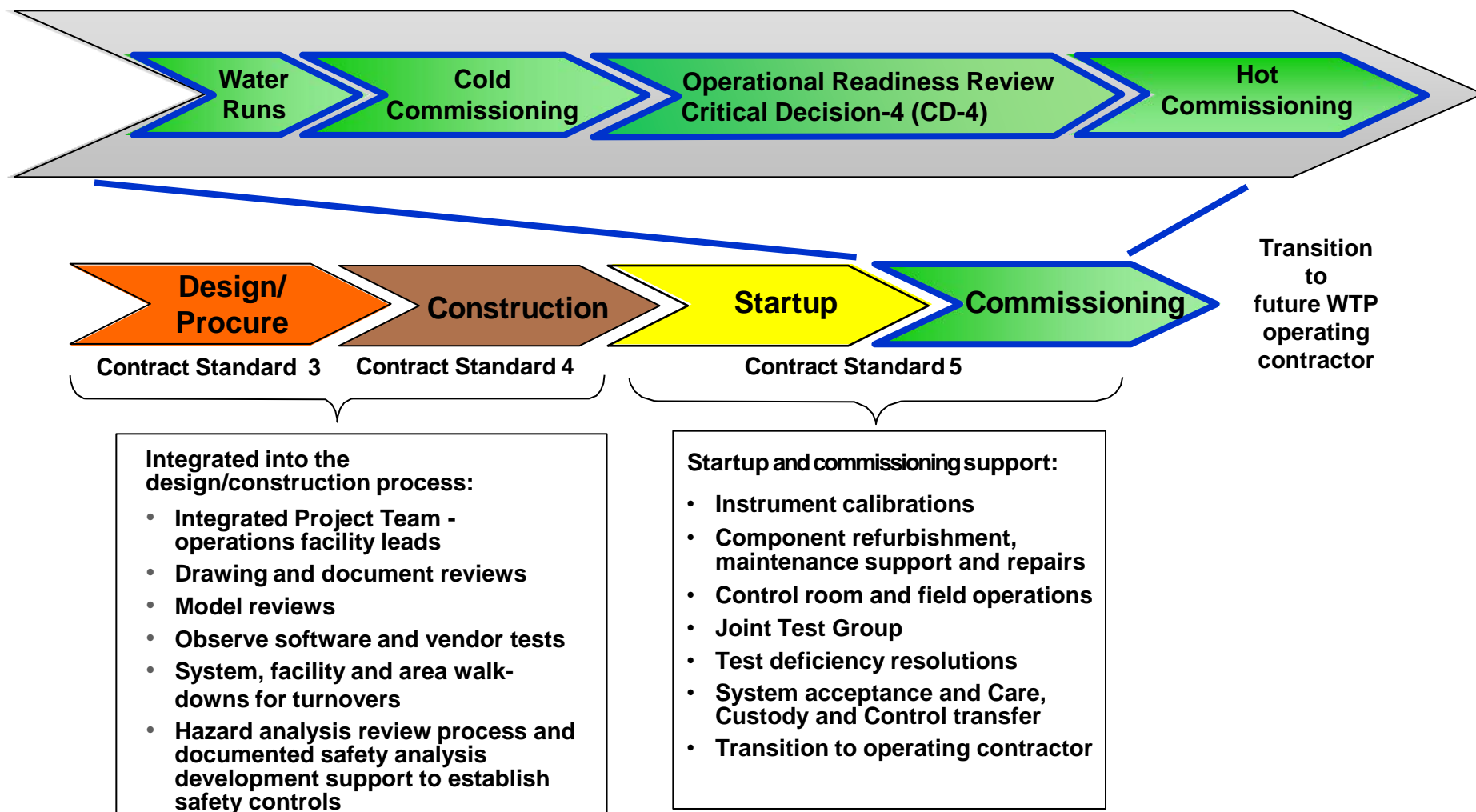
- Other DOE nuclear facilities
  - SRS and Hanford Tank Farms
  - Integrated Waste Treatment Unit (IWTU) in Idaho
  - SRS and Hanford nuclear material production facilities



## **Focus on Operability is Continuous**

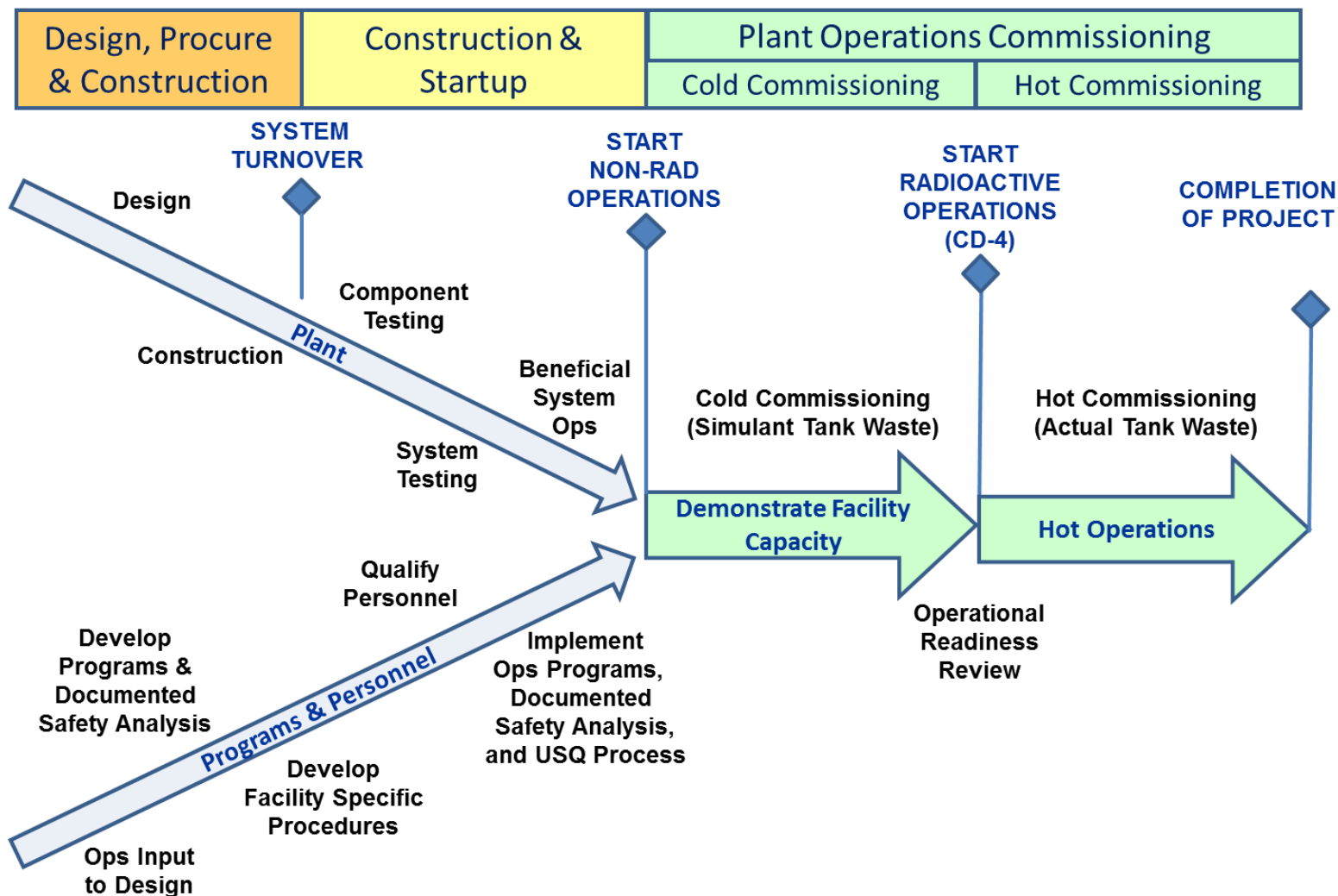
- Operability input and feedback occur throughout the lifecycle of the plant
  - Conceptual design
  - Detailed design and procurement
  - Construction
  - Startup testing
  - Commissioning testing
  - Operations and maintenance

# Operability Input – all Project Phases





## Project Phases







# Examples of Operations Influence on Design

- Pretreatment (PT) Facility
  - Reconfiguration to include hot cell
  - Replaceable components and piping (DOE “canyon” concepts)
  - Ability to modify/upgrade processes after radioactive operation
  - Remote connectors concepts from SRS and West Valley



# Examples of Operations Influence on Design

- HLW Facility
  - Removal of PJM mixed high solids vessels
- Laboratory - Hot cells and radiological lab layouts
- Control room layouts and operator console graphics
- Operations Requirements Document
- Numerous detailed changes as design has progressed
  - Design meetings
  - Design document reviews



## **Examples of Defense Waste Processing Facility Lessons Learned**

- Large bore jumper design (Graylok Connectors)
- Hanford electrical jumper with remote wire pull capability
- Remote crane and hoist – recovery features
- Remotability verification plan
- Dimensional record program for remote equipment
- Closed-loop steam system for process tank heating
- Remote pump and agitator vessel supports
- Transfer line leak detection boxes and pressure testing
- Macro-batch tank waste feed qualification



## **Examples of West Valley Lessons Learned**

- Glass former batch recipes for variable waste streams
- Air Displacement Slurry Pumps for feeding melters
- WTP melter design
- Melter off-gas components
- HLW Facility glass canister and grapple design
- HLW Facility glass canister welder
- HLW Facility glass canister decontamination
- Low activity waste and HLW Facilities glass container/  
canister smear testing
- Power manipulators on cranes
- Remote electrical connectors



## **Sources of Operability Input and Feedback**

- WTP Project
- Corporate – Bechtel and URS
- Vendors and suppliers
- DOE Office of River Protection and DOE Headquarters
- External review teams
- Stakeholders
- Training simulator
- Reliability, availability, maintainability, inspectability (RAMI) data and reviews
- Operational research modeling
- As Low As Reasonably Achievable (ALARA) reviews
- Failure mode, effects and criticality analysis



## **Commitment to Operability**

We will deliver a fully operational plant with qualified staff and supporting programs, procedures and documentation



## **Conclusion – Operability is Built In**

- WTP project is staffed with personnel experienced in startup, commissioning and operations at other vitrification and nuclear facilities
- Lessons learned from other vitrification facilities have been incorporated into the design





## **Conclusion – Input and Feedback are Continuous**

- Operability input and feedback are provided during all project phases
- External reviews provide independent sources of feedback and lessons learned
- Like other production facilities, operability and throughput improvements will continue throughout the mission



# Backup Slides

# Pretreatment Facility

*World's largest radioactive chemical separations facility*



Confirming and improving reliability and flexibility in black cells

- In-service inspection
- Mitigation of potential events



# High-Level Waste Vitrification Facility

*Turns high-level waste into glass with two 90-ton melters*



August 2014, DOE authorized resumption of engineering activities to complete design

- 440 feet X 275 feet x 95 feet tall
- 88,000 cubic yards concrete
- 11,500 tons of structural steel
- 165,000 feet piping
- 1.6 million feet electrical cable
- 1.1 million pounds heating and ventilation ductwork



# Low-Activity Waste Vitrification Facility

*Turns low-activity waste into glass in two 300-ton melters*



Priority is to complete Low-Activity Waste Vitrification Facility first and to begin operations with direct-feed until the Pretreatment Facility is completed

- 330 feet X 240 feet x 90 feet tall
- 28,500 cubic yards concrete
- 6,200 tons of structural steel
- 103,000 feet piping
- 840,000 feet electrical cable
- 945,000 pounds heating and ventilation ductwork

# Analytical Laboratory

*Ensures glass meets regulatory requirements 10,000 samples each year*



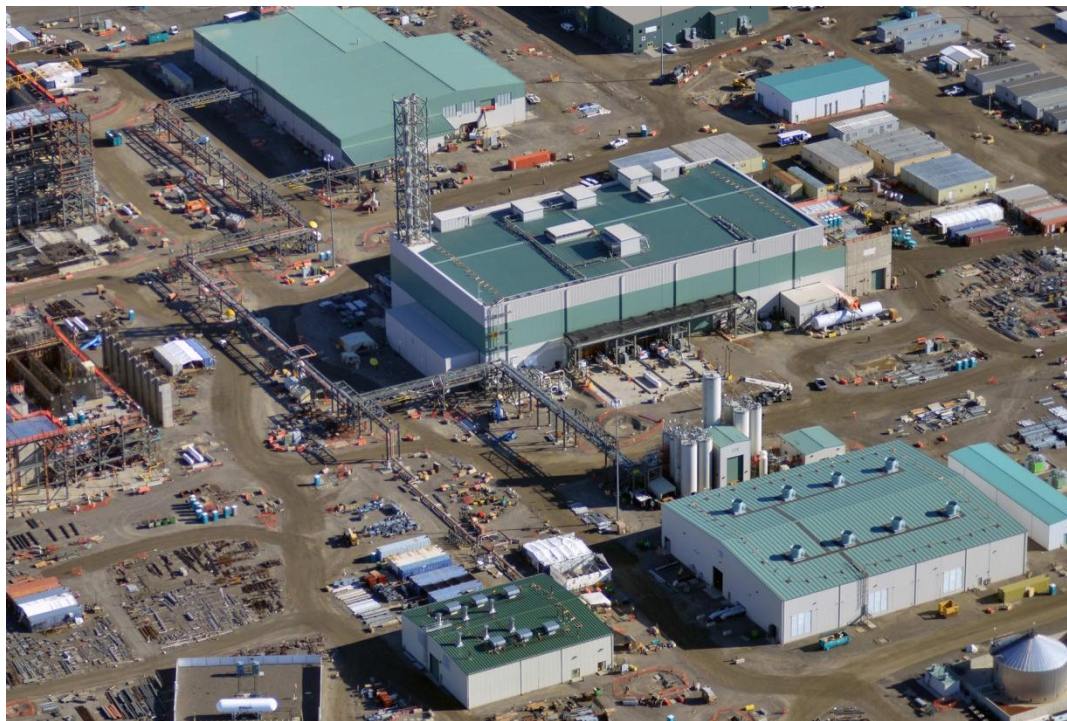
Priority is to complete Lab to provide laboratory sampling of direct-feed low-activity waste and glass product

- 320 feet X 180 feet x 45 feet tall
- 12,000 cubic yards concrete
- 1,800 tons of structural steel
- 35,000 feet piping
- 172,000 feet electrical cable
- 314,500 pounds heating and ventilation ductwork



# Balance of Facilities

*Vast infrastructure to support operations*



Priority is to complete Balance of Facilities to provide the infrastructure needed to produce low-activity glass

- Steam plant
- Chiller compressor facility
- Electrical substation and switchgear
- Water treatment facility
- Glass former storage
- Standby and emergency power generators
- Cooling tower
- Underground waste transfer systems